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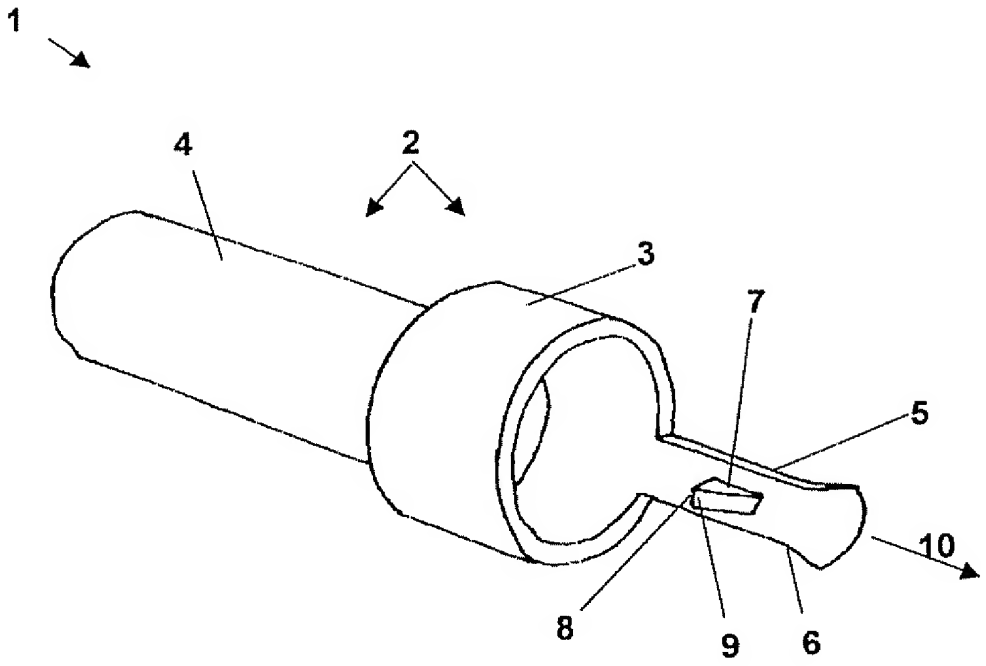
Figure 1



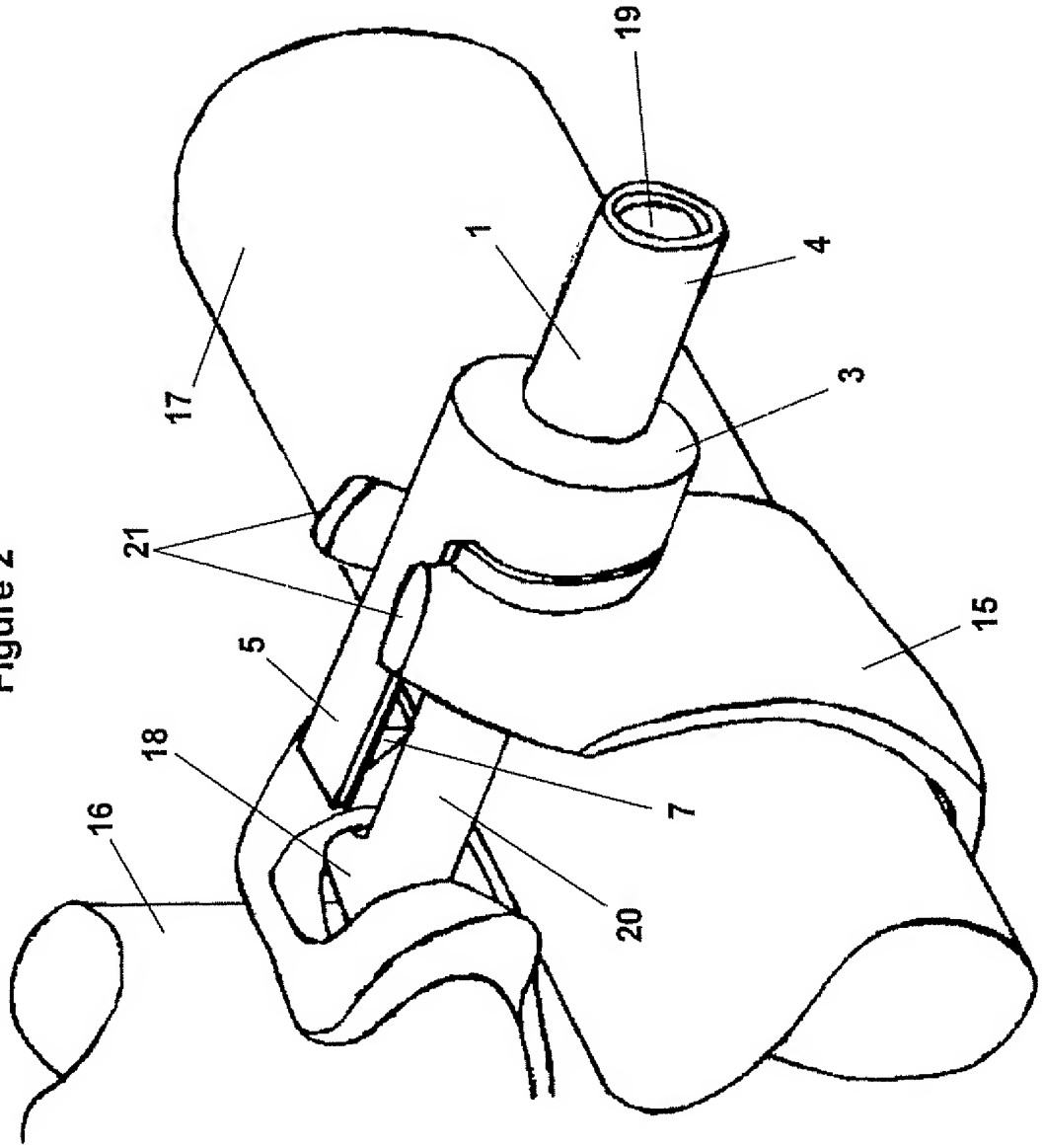


Figure 2

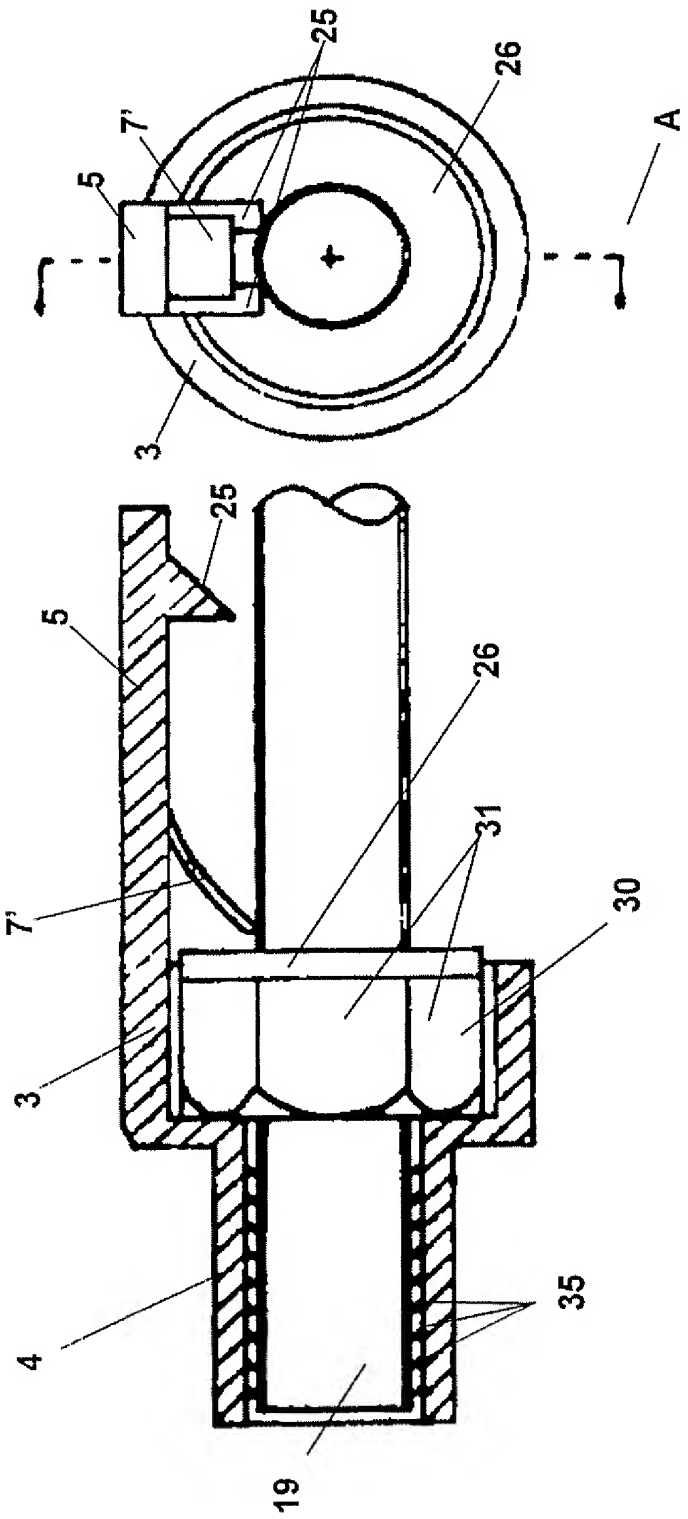
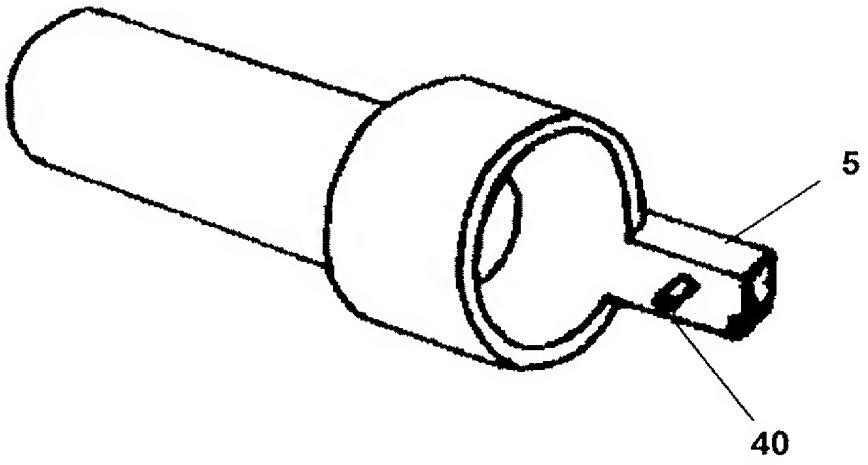


Figure 3

Figure 4



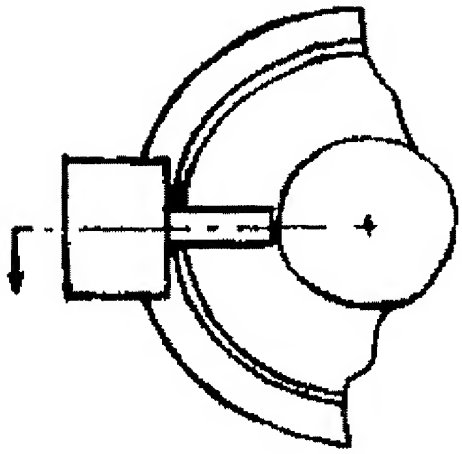
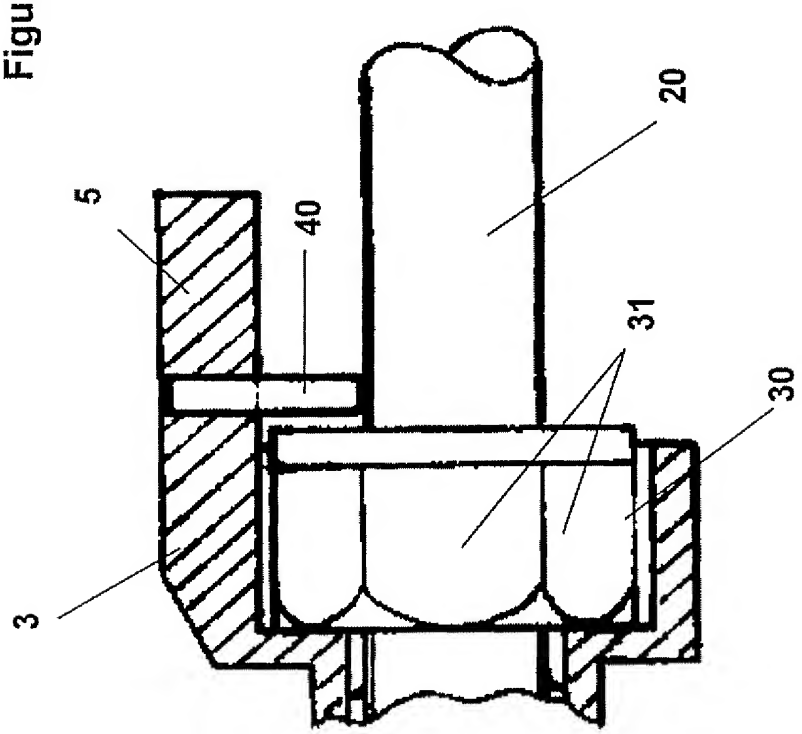


Figure 5



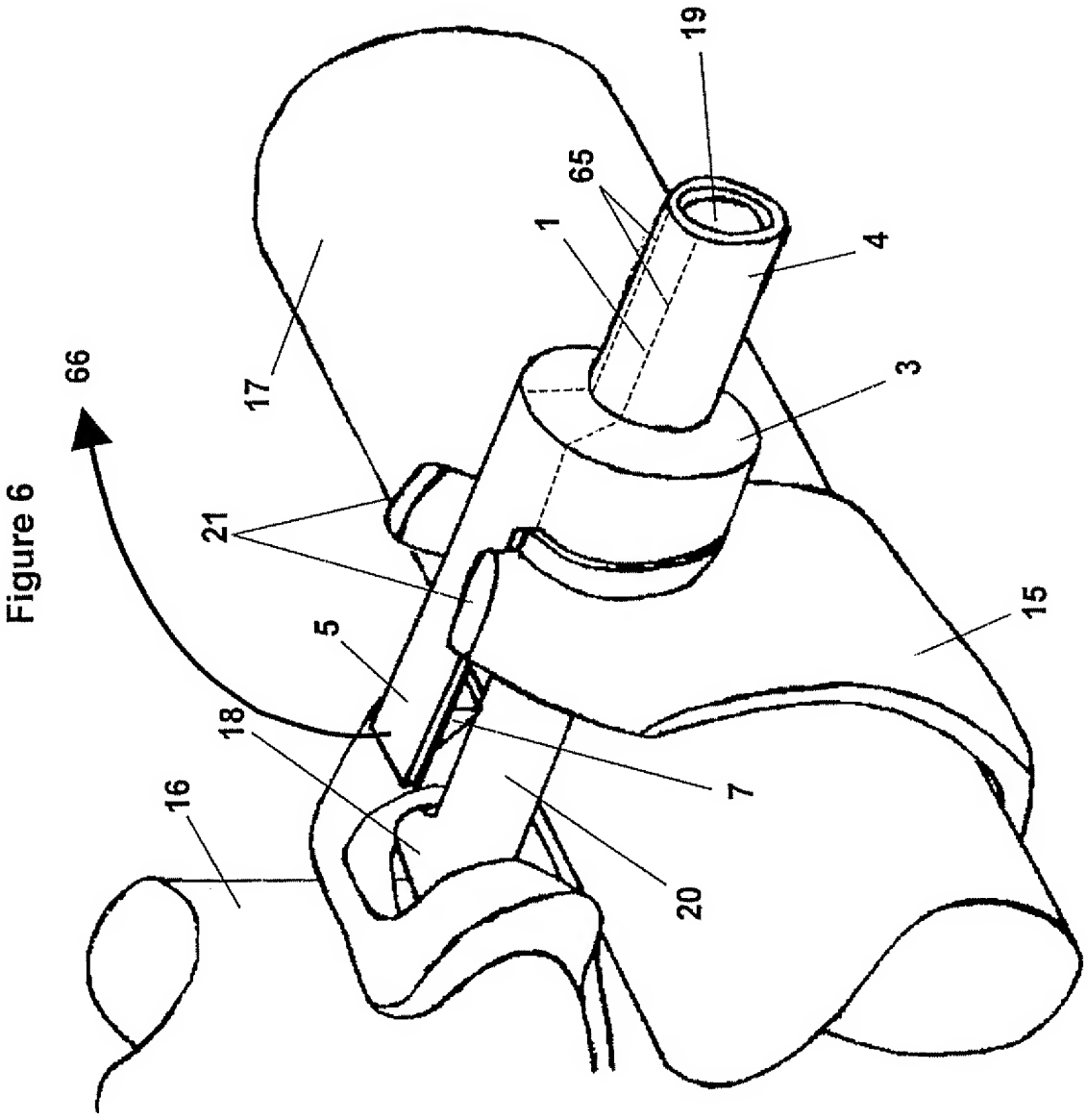


Figure 6

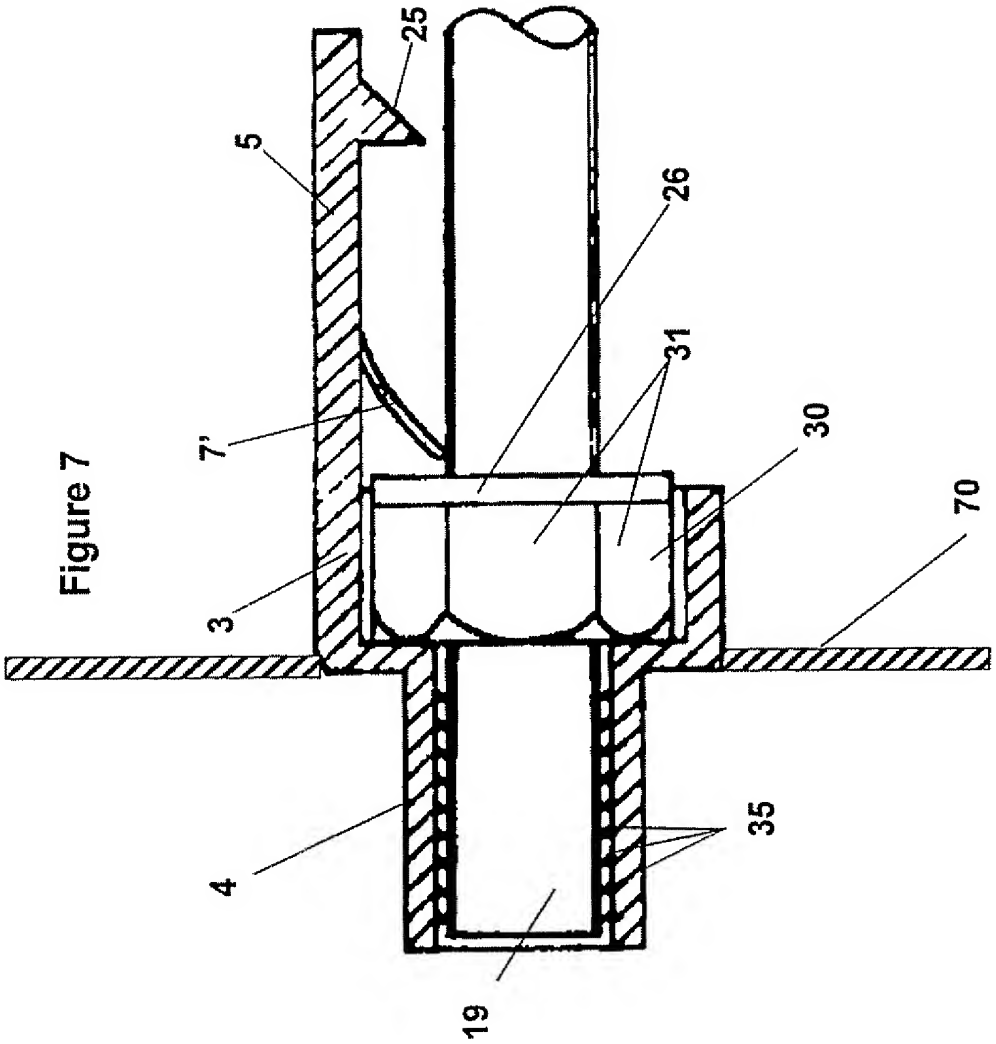


Figure 7

ANTI-TAMPER DEVICE

The present invention relates to an anti-tamper device for use with a nut when engaged upon a threaded shank. The invention finds particular application in the field of scaffolding.

"Tube and fitting" scaffolding is the most common form of falsework for building access in the United Kingdom. It is also used extensively worldwide. Its popularity derives from its simplicity and ease of use. However, this falsework is often modified by unauthorised users, such modifications including the moving and/or removal of components such as rails, couplings and so on. This is typically to provide "short-cut" access points to the falsework structure at the site in question. It has become known for other tradesmen to carry a scaffolder's spanner in their toolkit for this very purpose. This is extremely undesirable and dangerous. In many cases, it is also in contravention of site and health and safety regulations.

Tube and fitting scaffolding is held together using "clamps" (also referred to as "couplers"), together with 7/16" (11.1mm) Whitworth threaded bolts. All of the fittings are standardised in this manner and no other primary methods of fixing are employed. Other less popular sizes of tube and fitting scaffold nut and thread include ½" (12.7mm) Whitworth.

It is extremely desirable to prohibit unauthorised alteration or tampering with such scaffolding structures, particularly from a safety point of view. However, the tube and fitting scaffolding has become popular due to its simplicity and therefore it is desirable that any such means of prohibiting unauthorised modification is itself inexpensive and simple to use. In particular an expensive solution is unlikely to find favour in a cost conscious and relatively unregulated construction industry.

In accordance with the invention we provide an anti-tamper device for use with a nut when engaged upon a threaded shank, the device comprising:-

a cover for location around the nut so as to prevent engagement between a tool and the nut;

a locking member adapted to prevent the removal of the cover from its location around the nut; and

an anti-rotation member for preventing rotation of the device with respect to the shank,

the device further comprising a weakened region adapted to allow removal of the device by the irreversible deformation and/or fracture of the device in the weakened region.

The present invention provides an elegant and inexpensive solution to this widespread problem by focussing on the component which maintains the integrity of the scaffolding, namely the nuts which are engaged upon threaded shanks. Great advantage is provided by the device according to the invention in that it combines a cover to prevent engagement between a tool held by an unauthorised worker and the nut in question, a locking member to prevent the device from being removed, and an anti-rotation member to ensure that the device is not defeated merely by becoming an extension of the nut surfaces (and turned with the nut).

Typically therefore the cover is operable so as to prevent access to the nut, and in particular the flat nut surfaces, by the tool of an unauthorised person. Such a tool is typically a scaffolder's spanner and therefore preferably the cover prevents the tool from gaining sufficient purchase upon the nut so as to cause it

to rotate with respect to its shank and thereby become loosened. This may be achieved for example by providing the cover with a smooth outer surface to prevent it from being gripped readily. This surface may also be tapered or take the form of a conical frustum so as to enhance this effect.

In some examples, the cover may have internal surfaces which engage with the nut so as to prevent rotation of the cover with respect to the nut. These surfaces may conform with those of the nut so as to provide a tight fit of the cover on the nut. In other examples, the cover may be arranged to not directly engage with the nut and therefore may be loosely fitted so as to allow rotation of the cover with respect to the nut itself.

The cover may take a number of forms although typically it is at least a collar surrounding or enclosing the flats of the nut. The cover may also have parts which enclose some of the other surfaces of the nut, for example the top and bottom surfaces parallel to the axis of rotation of the nut.

In most cases when the nut is tightened upon the threaded shank, typically a portion of the threaded shank remains exposed. Preferably at least part of the exposed shank, and more preferably all of the exposed shank, is also enclosed by the cover. This is advantageous since it further restricts access to the nut and also in that a covered shank is less likely to cause injury to users. It also provides a larger area for visibility purposes in the case where tamper-evidence is important.

An internal surface of the cover, facing the shank, may be provided with one or more protrusions, these being arranged to engage in use with the thread of the shank so as to prevent removal of the device from the shank in an axial direction. Such protrusions may be in the form of teeth or ridges, and preferably a number of such protrusions are arranged axially along the internal surface of the cover. The protrusions may be formed as part of an insert which is attached or fitted in to the sleeve. Their function is therefore preferably as a ratchet in which the cover can be slid onto the shank and nut in a first direction, the protrusions thereby deflecting as they pass over the ridges of the thread. In attempting to remove the cover by reversing the direction, the protrusions mesh with the thread so as to resist the removal of the device. These protrusions therefore act as a locking device to resist removal of the device from the nut when in a tightened position upon the shank. A tightening mechanism might also be provided as part of the sleeve which locks or is locked onto the shank thread section.

Typically the shank forms part of a clamp or coupler, the clamp or coupler having jaws through which part of the shank is received so as to adopt a closed position. Such clamps or couplers are known in the art, particularly in the scaffolding industry, and are operable by forming a closable enclosure. The shank forms one side of the clamp components which enclose a member to be clamped or coupled. In many cases one end of the shank is pivotably coupled to part of the clamp or coupler so as to allow transverse movement of the shank through the jaws. In this way the shank adopts a closed position in which the nut is tightened upon the shank.

The jaws define a gap and we have realised that this can be used to good effect with an anti-rotation feature of the device. Typically therefore, the anti-rotation member comprises a projection arranged in use to be positioned between the jaws of the coupler or clamp when the shank is in the closed position, the shank having achieved this position by passing transversely through the jaws. The anti-rotation feature is provided by the projection impacting against one or more of the jaws of the clamp or coupler upon attempted rotation of the device. The advantage of this is that, even if it were possible to grip the nut sufficiently through the cover so as to allow the nut to rotate upon the shank, the anti-rotation member would nevertheless prevent rotation of the cover itself with respect to the shank. The nut can therefore only be undone in this situation by removing the device completely or applying such a large force that the projection breaks off the device.

As described above, one example of a locking device may be provided using internal protrusions upon part of the cover enclosing the shank. As an alternative or as an additional locking device, a detent may be positioned upon the projection so as to face the shank. Either or each of the projection or detent is in this case formed from a resilient material so that, when fitting the device in use, the projection and/or detent is deflected to allow the passage of the detent past the nut and any washer adjacent thereto. Subsequent removal of the device in the reverse direction is prevented by the engagement of the detent with the nut or the washer. The detent therefore provides a ratchet function and may take the form of a tooth, barb and so on, including multiple instances thereof. The anti-rotation projection may be stiffened following the positioning of the device onto a joint, by inserting a substantially rigid member such as a rod into a corresponding hole/channel down the length of the projection.

In an alternative example, the detent may take the form of a pin which is separate from the device and is fitted (preferably irreversibly) through a hole in the extension of the device when the extension is correctly located upon the tightened nut and shank. The pin may be metallic or formed from a plastics material and take a form which is substantially rigid. Likewise, in this case the

extension should be provided with no or a low resilience so as to prevent deflection of the extension and/or pin.

In normal use, the anti-tamper device remains fitted to the nut and shank whilst the falsework remains in use. However, upon dismantling or authorised modification of the falsework, it is desirable to enable the anti-tamper devices to be removed in a relatively straightforward manner. It is important of course to ensure that such removal is evident by the absence or obvious deformation of the devices. It is preferable therefore that, upon removal, the anti-tamper device becomes unusable. In accordance with the invention, the device further comprises a weakened region which is adapted to allow removal of the device only by the irreversible deformable and/or fracture of the device in the weakened region. Such a weakened region may be formed by local thinning or perforation of the device material.

Preferably, one or more weakened sections may be provided which extend from the base of the projection in a substantially axial direction across the device. The projection forming the anti-rotation device may therefore advantageously adopt an additional function in that it becomes a tab which can be pulled manually so as to cause rupture of the device along its axis. The device is therefore removed from the nut and thereafter allows access to the nut so as to allow the falsework to be dismantled. The weakened section may take the form of a spiral running down the length of the sleeve.

It is particularly advantageous that the device is tamper-evident. Such tamper-evidence may take a number of forms. In some examples the device may be highly visible itself, such as being formed from fluorescent or brightly coloured materials. It may alternatively or additionally be fitted with a highly visible label, perhaps containing a warning notice. The tamper-evidence in this case is provided merely by the obvious absence of the device upon a particular nut and shank. In other cases, tamper-evidence may be provided by materials which adopt a colour change upon being exposed to deformation.

Whilst the anti-tamper device of the present invention has a field of use in scaffolding, it will be appreciated that it may also be used in a broader sense outside the scaffolding industry.

Some examples of anti-tamper devices according to the present invention are now described, with reference to the accompanying drawings, in which:-

Figure 1 shows a first example of an anti-tamper device according to the invention;

Figure 2 shows the use of the device according to the first example in association with a scaffolding clamp;

Figure 3 shows sectional and axial representations of a second example of the invention;

Figure 4 shows an alternative third example using a metallic pin;

Figure 5 shows the third example in section and in axial representation;

Figure 6 shows an example of weakness paths; and

Figure 7 shows a fourth example in section

A first example of an anti-tamper device according to the invention is shown in Figure 1. The device comprises a cover 2 being formed from a collar 3 and sleeve 4. Each of the collar 3 and sleeve 4 take the general form of hollow cylinders of substantially circular cross-section. The internal diameter of the sleeve 4 is of a dimension slightly larger than that of the threaded part of a 7/16" (11.1mm) Whitworth bolt. The collar 3 (of larger internal diameter than that of the sleeve 4), has a diameter which is, in this example, just larger than the "edge-to-edge" diameter of the opposed edges of a standard nut for a 7/16" (11.1mm) Whitworth bolt, these edges being defined by where the flat surfaces meet one another. The benefits of this are that it provides a loose fit allowing easy fitting of the device, the use of a small amount of material and the prevention of the use of the cover as an extension of the nut itself. A tight fitting cover by comparison, having internal surfaces conforming with the nut, has some advantages in providing further reduced access to the nut surfaces. The device may be formed from a heat-shrinkable material so that, once fitted to the tightened nut and shank, it may be heated, causing it to grip these tightly.

In this case the collar 3 and sleeve 4 are formed from a substantially similar thickness material therefore the external diameter of the sleeve 4 is somewhat smaller than the collar 3 although this is not essential. The sleeve 4

and collar 3 are joined at one end of each respective cylinder, so as to form the cover 2 as a single component. The collar 3 and sleeve 4 are arranged upon a common axis, this defining a common axis of the cover 2

On the opposite side of the collar 3 to the position where the sleeve 4 is joined, a projection is provided in the form of an extension 5, this extending part of the cylindrical surface of the collar 3 in a substantially axial direction away from the sleeve 4. At an end 6 of the extension 5, the extension is flattened and curved slightly away from the central axis of the device 1. This allows the end 6 to be deflected past a nut or washer when the device is being fitted. It also allows the extension 5 to be lifted and gripped when the device 1 is being removed and destroyed after use.

On an inner surface of the extension 5, that is, facing the axis of the device 1, a detent is provided in the form of a tooth 7. This forms a locking device in this example, the tooth having a flat surface 8 being substantially normal to the surface of the extension 5, and a ramped surface 9 angled away from the surface of the extension 5 in a direction towards the collar 3.

The entire device in the first example is formed from a plastics material, such as polyamide containing a fluorescent dye. Other example materials include polypropylene, polyethylene and so on. Since this material is to some extent resilient, the extension 5, and tooth 7 act with respect to the edge of a nut or washer as a ratchet and pawl when the device 1 is moved into its position of use upon a nut and shank in a direction 10. Note that the nut and shank are not shown in Figure 1.

It should be noted that the distal end of the sleeve 4, opposite to that of the collar 3, may either be a closed end or an open end. An open end is advantageous in that it allows different lengths of shank to be used.

Figure 2 shows the device 1 in use in association with the nut and shank of a scaffolding clamp. The scaffolding clamp is indicated generally at 15, this being operable to rigidly connect together scaffolding poles 16 and 17 so as to form an orthogonal joint. The scaffolding clamp has an approximately "C" shaped section of sufficient gape to receive the diameter of a scaffolding pole 17. Once fitted within the "C", a shank 20 is moved so as to close the open

ends of the "C" in a known manner, so as to fully enclose the scaffolding pole 17. The shank is pivotable towards and away from the pole 17 about a point indicated at 18. The shank is threaded as a Whitworth bolt in at least the regions which are obscured in Figure 2 by the collar 3 and sleeve 4. The end of the shank can be seen at 19 adjacent to the end of the sleeve 4.

In order to receive the shank in the part of the "C" opposed to the part 18 from which it is pivoted, the clamp 15 is provided with two jaws 21, these being spaced apart by an amount larger than the diameter of the shank 20. The shank 20 is passed through these jaws in order to adopt a closed position when in use. When in this closed position, a nut is tightened onto the shank 20 so as to prevent the shank from being moved through the jaws, thereby securing the pole 17. The device 1 is fitted to the tightened nut and shank.

As can be seen in Figure 2, the extension 5 is of a size which permits it to just pass through the jaws 21. After the tightening of the nut upon the shank of the clamp 15, the device 1 is pushed onto the exposed part of the shank 19 and the nut. The collar 3 passes over the surface of the nut so as to enclose it, and the sleeve 4 likewise encloses the shank. In order to adopt this position, when being moved axially along the shank, the extension 5 is firstly oriented so as to allow it to pass through the jaws 21. In addition, the surface 9 of the detent impacts against the nut and causes deflection of the end of the extension 5 so as to allow passage of the detent beyond the nut. Once beyond the nut, the extension 5 returns to its rest geometry. This means that the action of withdrawing the cover 1 axially causes the flat surface 8 of the tooth 7 to impact against the surface of the nut and thereby removal is prevented unless the extension 5 is deflected.

A second example of a device according to the invention is shown in Figure 3. This contains two modifications to the first example. The first modification is that the extension 5 contains a modified detent 7', this being a resilient tongue that is angled towards the cover 2.

As is also shown in Figure 3, a rigid guard 25 is positioned further towards the distal end 6 of the extension 5 with respect to the tongue 7'. The function of the guard 25 is to prevent a tool (such as a screwdriver or chisel)

from being forced along the gap between the extension and shank, so as to deflect the tongue 7' and aid in the removal of the device.

Figure 3 shows a section and an axial representation, the section being taken at the position A as indicated. The section in Figure 3 shows the shank 20. The nut 30 is illustrated in its position of use, namely threaded and tightened upon the shank 20. A washer 26 is also shown. The flat surfaces of the nut are indicated at 31.

The second manner in which this example differs from that of the first is that, in the sleeve 4, a number of circumferential ridges 35 are provided as protrusions which engage with the thread of the shank 20. Note that the details of the shank thread are not shown in Figure 3. The cross-section of each particular ridge has an analogous form to that of the tooth 7, namely a surface substantially normal to the axial direction, and another surface angled away from the inner surface of the sleeve 4. This again provides a ratchet action with the thread of the shank 20. The ridges 35 upon the internal surface of the shank 20 provide the primary locking member for the second example 3.

It should be noted that a washer 26 is often used in association with the nut 30. In this case, the washer typically has a diameter which is not longer than the edge-to-edge diameter of the nut. The collar 3 can therefore be adapted to enclose the washer and the nut.

A third example of an anti-tamper device for scaffolding is shown in Figure 4. This is broadly similar to that of Figure 1, the main difference being that the tooth 7 is replaced by a metallic pin 40. Here the metallic pin 40 is not integral with the device and rather fits through a corresponding aperture within the extension 5. The device 1 is fitted without the metallic pin 40 and, once in place, the pin is hammered into position from the reverse side of the extension 5, through an aperture of similar cross-section. This is shown in more detail in Figure 5, with both a section and an axial representation being illustrated.

It will be appreciated that the generic design of the anti-tamper device according to the invention can be used on all available fixing nuts and in all the various joint orientations of scaffolding. It is of particular benefit when used for securing handrails and other important safety apparatus. Once fitted, the

extension 5 passing through the jaws 21 of the clamp prevents rotation of the device with respect to the shank. The locking device prevents the nut from being exposed.

The device is preferably formed from an extremely brightly coloured material such as a fluorescent plastic, so that its absence is immediately noticed by a site inspector. It may also be provided with a highly visible label which may bear a warning to deter unauthorised removal.

It is preferable that the removal of the device causes it to be destroyed so that it cannot be reused. In order to remove the device it should preferably be cut or torn from end to end or at least to a sufficient extent so as to permit it to be removed. To achieve this, part of the extension 5 can be formed as a tab and a pre-formed weakness path in the device can be provided. Along such a path, the radial strength is reduced in manufacture so as to assist with tearing and removal. The path may be substantially linear or may take other forms, such as a spiral around the shank thread. Pre-formed weaknesses in articles are known in unrelated fields such as drinks packaging.

An example of this is shown in Figure 6. Here two perforated paths 65 are provided running across the collar 3 and sleeve 4 from the base of the extension 5. To remove the device, the extension 5 is gripped and pulled sharply in the direction indicated by the arrow 66.

A fourth example device is shown in Figure 7. The collar 3 has an additional annular surface acting as a disc 70, with the collar and sleeve at the centre. The diameter of the disc 70 is preferably 75 to 100 millimetres. The disc is brightly coloured (preferably fluorescent) and aids a site inspector in visually checking the presence of the devices upon each nut and shank of the scaffolding falsework. Such a disc can be used in association with each of the other examples described herein. The term "disc" is intended to include circular discs and other shapes.

The benefits of all such anti-tamper devices are that, when fitted, access to the nut is prohibited and relative rotation is prevented to stop the nut being undone through the device cover. Such a device is low cost, simple and quick

to fit. The invention therefore provides a simple and effective means of improving scaffolding safety.

Whilst the foregoing examples have focussed upon the use of the device in terms of scaffolding, where it finds its primary application, it will be appreciated that the device may be used in other situations where it is desirable to prevent access to a nut upon a threaded shank.

CLAIMS

1 An anti-tamper device for use with a nut when engaged upon a threaded shank, the device comprising.-

a cover for location around the nut so as to prevent engagement between a tool and the nut;

a locking member adapted to prevent the removal of the cover from its location around the nut; and

an anti-rotation member for preventing rotation of the device with respect to the shank,

the device further comprising a weakened region adapted to allow removal of the device by the irreversible deformation and/or fracture of the device in the weakened region.

2. A device according to claim 1, wherein the cover prevents access by the tool to the flat surfaces of the nut.

3. A device according to any of the preceding claims, wherein the cover has a smooth outer surface so as to prevent it from being gripped readily.

4. A device according to any of the preceding claims wherein the cover has internal surfaces which engage with the nut so as to prevent rotation of the cover with respect to the nut.

5. A device according to any of claims 1 to 3, wherein the cover is rotatable with respect to the nut.

6. Apparatus according to any of the preceding claims wherein the cover is a collar.

7. A device according to any of the preceding claims wherein the cover is arranged to extend along the shank so as to at least partially enclose the shank.

8 A device according to any of the preceding claims when the shank forms part of a clamp or coupler, the clamp or coupler having jaws through which part of the shank is received so as to adopt a closed position.

9. A device according to any of the preceding claims wherein the anti-rotation member comprises a projection arranged to be positioned between the jaws of

the coupler or clamp when the nut and shank are in a closed position, this position being adopted by the shank passing transversely through the jaws

10. A device according to claim 9 wherein rotation between the device and the shank is prevented by the projection impacting against one or more of the jaws of the clamp or coupler.

11. A device according to claim 9 or claim 10, wherein the locking device comprises a detent which is fitted to the projection following said positioning and which prevents removal of the device by engagement with the nut or any washer positioned adjacent thereto.

12. A device according to claim 11, wherein the detent is fitted by passing it through a hole in the projection such that the detent is held in position by the walls of the hole.

13. A device according to claim 11 or claim 12, wherein the detent is a pin.

14. A device according to any of claims 1 to 10 wherein the locking device comprises a detent positioned upon the projection facing the shank and wherein the projection and/or detent is resilient, such that in order to fit the device in use, the detent is passed in a first direction past the nut and any washer adjacent thereto, and wherein subsequent removal of the device in the direction opposed to the first direction is prevented by engagement of the detent with the nut or any said washer.

15. A device according to claim 14 wherein the detent is a tooth or barb.

16. A device according to claim 14 or claim 15, further comprising a guard to prevent access to the detent.

17. A device according to claim 1, wherein the weakened region comprises one or more regions extending from the base of the projection in a substantially axial direction across the device.

18. A device according to any of the preceding claims, wherein the cover further comprises an extensive surface in the form of a disc so as to increase the device visibility when in use.

19. A device according to any of the preceding claims wherein the device is tamper-evident.

20. A device according to any of the preceding claims wherein the device further comprises a highly visible label.

21. A device according to any of the preceding claims wherein the device is a scaffolding anti-tamper device.

22. A device as substantially hereinbefore described with reference to any of the accompanying drawings.